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Facial Signs of Emotional Experience

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Spontaneous facial expressions were found to provide accurate information about more specific aspects of emotional experience than just the pleasant versus unpleasant distinction. Videotape records were gathered while subjects viewed motion picture films and then reported on their subjective experience. A new technique for measuring facial movement isolated a particular type of smile that was related to differences in reported happiness between those who showed this action and those who did not, to the intensity of happiness, and to which of two happy experiences was reported as happiest. Those who showed a set of facial actions hypothesized to be signs of various negative affects reported experiencing more negative emotion than those who did not show these actions. How much these facial actions were shown was related to the reported intensity of negative affect. Specific facial actions associated with the experience of disgust were identified.

Current emotion theorists disagree about whether different emotions are characterized by distinctive bodily response system changes (e.g., autonomic nervous system [ANS] or facial expression patterning). Those who follow Schachter and Singer (1962) claim that cognitive expectations are the only important determinants of which emotion is subjectively experienced. ANS activity is not patterned but reflects the extent, not the type, of emotion that is aroused. This viewpoint has largely ignored the possibility that facial expressions might be a differentiated response system distinguishing among emotions. Those who disagree with Schachter and Singer do not share the same theory, but each has emphasized response system changes that are distinctive for each emotion: the ANS by Lazarus (1966) and facial expressions by Plutchik (1962) and Tomkins (1962, 1963).

If facial expressions are distinctive for each emotion, this would have important consequences both intrapersonally, coloring the subjective experience, and interpersonally, signaling to others how one feels. Although both roles have been recognized, those theorizing about the role of the face in the experience of emotion have emphasized intrapersonal functions. For example, Tomkins (1962) defined the subjective experience of emotion as the feedback from the facial muscular changes. Recent experiments have investigated how a subject's performance of different muscular movements influences his or her subjective experience of emotion (Izard, 1977; Laird, 1974; Tourangeau & Ellsworth, 1979). However, the face may also influence a person's emotional experience by providing signals to others about how the person feels. If B perceives A's facial expression of emotion, B's behavior toward A may change, and A's notice of this may influence or determine A's experience of emotion.

The viability of proposals that facial expression plays important, perhaps multiple, roles in the experience of emotion depends on the capability of the face to (a) show distinctive expressions for each of a number of emotions, such as fear, anger, disgust, happiness, and so forth, and (b) vary with the

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felt differences in the intensity of emotion. Such evidence does not exist for spontaneously occurring emotion. The data only show that the face can provide information about the much simpler, grosser distinction between whether an emotion is pleasant or unpleasant.

Much of the current renascence of interest in the face was generated by cross-cultural studies that found universality. Most of these experiments, however, did not examine spontaneous behavior. Instead people in different cultures were asked to label contrived expressions (Ekman & Friesen, 1971; Ekman, Sorenson, & Friesen, 1969; Izard, 1971). The one study that examined spontaneous facial expression in two cultures (Ekman, 1972) focused only on the gross distinction between pleasant and unpleasant emotions. Since then a number of studies within a single culture have documented but not extended the finding that the face can show whether an emotion is pleasant or unpleasant. (See review of such studies from 1970 to 1979 in Ekman & Oster, 1979, and of such studies from 1914 to 1970 in Ekman, Friesen, & Ellsworth, 1972, chapters 15 and 16.)

The primary purpose of the present experiment was to venture beyond the pleasant versus unpleasant dichotomy to determine whether spontaneous facial expressions can provide information about more specific aspects of emotional experience: Does facial behavior vary with the felt intensity of a pleasant or of an unpleasant emotion? Are subtle differences between pleasant experiences shown on the face? Is there one type of smile more than other smiles that relates to a pleasant experience? Can a particular negative emotion be read from the face, not just the more general information that the emotion is unpleasant? A second purpose of this study was to obtain evidence about how spontaneous facial actions might be related to a person's subjective experience of emotion. Most previous studies instead have focused on how spontaneous facial behavior varies with some manipulations in experimental condition, or signals information to others.

Either of two complementary methods could be used to score facial behavior: directly measuring facial actions when different emotions occur or asking observers to make emotion judgments when viewing samples of such facial behavior. We chose direct measurement of facial actions to accomplish the third purpose of this experiment—to test hypotheses about the particular facial actions that signal particular aspects of emotion (e.g., Ekman & Friesen, 1975; Ekman, Friesen, & Tomkins, 1971; Izard, 1971). So far these formulations have been tested only in terms of their ability to identify contrived facial expressions, not spontaneously occurring emotion. We sought to provide a sounder basis about what different facial actions may signify.

Method

A new technique for measuring facial behavior, the Facial Action Coding System (Ekman & Friesen 1976, 1978a), was applied to videotape records gathered while subjects viewed positive and stress-inducing motion picture films and then reported on their subjective experience.

Subjects

Thirty-five right-handed, female Caucasians, ranging in age from 18 to 35 years ($M = 25.14$), volunteered as subjects. Subjects of only one gender were recruited, since Hall (1978) has shown some differences in facial encoding associated with gender. It was thought that female subjects might feel more comfortable than males with the female experimenter (S.A.). Through advertisements subjects were recruited to participate in an experiment on psychophysiology in which brain waves, heart rate, muscle tension, basal skin resistance (BSR), and respiration would be recorded while they watched films. They were not told that we were interested in emotion or that they would be videotaped. This information was witheld until after the experiment to avoid self-conscious behavior.

Stimuli

In the positive condition, subjects saw films intended to induce positive affect; in the negative condition, subjects saw a film intended to induce negative affect. The positive films consisted of three distinct 1-min. films produced by Ekman and Friesen (1974) that yielded similar self-reports of strong positive affect. One film showed a gorilla playing in a zoo, another showed ocean waves, and the third showed a puppy playing with a flower. The reactions to the ocean film are not reported, since this film was designed to yield little observable facial response; indeed, this was the case. Only seven of the

subjects showed any facial response to the ocean film. This film had been included for the purpose of another investigation of the psychophysiological responses of these subjects (Ancoli, 1979). The three positive films were always shown in the same order, with a 10-sec blank period between each: gorilla, ocean, and then puppy.

The film intended to produce negative affect was an edited version of a workshop accident film first used in research by Birnbaum (1964). Other investigators (Lazarus, 1966; Ellsworth, Note 1) found that subjects reported experiencing fear and disgust. The film was edited to eliminate most of the scenes other than those directly leading to and showing two accidents: A man has the tip of his finger cut off by a saw, and a man dies after a plank of wood is thrust through his chest by a circular saw. These two scenes were always shown in the same order, with only a few scenes between them—first the finger cut, then the death.

Subjective Experience of Emotion

Subjects reported their emotional reactions on a questionnaire composed of a set of 9-point scales that previous studies (Ekman & Friesen, 1974) had found sensitive to differential reactions to the stimulus films. Separate scales were included for interest, anger, disgust, fear, happiness, pain, sadness, surprise, and arousal. Each scale was unipolar, with 0 representing no emotion and 8 the strongest feeling. Instructions explained that the

> strength of a feeling should be viewed as a combination of (a) the number of times you felt the emotion—its frequency; (b) the length of time you felt the emotion—its duration; and (c) how intense or extreme the emotions was—its intensity.

Only two of the emotion terms were explained. Pain was said to refer to the experience of empathetic pain. Arousal was said to be an index of the total emotional state.

Procedure

Each subject was seen individually. She was seated in a 2 m × 2 m electrically shielded room. Leads for recording electroencephalogram, heart rate, respiration, BSR, and skeletal muscle electromyogram were attached. (Results on these autonomic measures are reported in Ancoli, 1979.) The videocamera was concealed. The lights were left on in the room, and the subject was told that she had been randomly selected to be in a bright-light condition in the experiment.

After the instructions, the subject was left alone in the room, and all further communication was by means of an audio-only intercom. There was a 20-min. baseline period in which the subject was instructed to relax. There was no video-recording during this period. The subject then was asked to fill out the emotion questionnaire to describe her feelings during the baseline period. Next, the subject was exposed to either the positive or negative film condition. The order of presenting the positive and negative conditions was counterbalanced among the subjects. The films were shown at eye level on a small screen, 18 × 30 cm, 60 cm away from the subject. At the conclusion of the first experimental condition, the subject filled out a second emotion questionnaire. If the first condition had been positive, she was required to fill out separate questionnaires to report her reactions to each film: gorilla, ocean, and puppy. If the first condition had been negative, she was required to fill out separate questionnaires to report her reactions to each of the two accidents. After the questionnaires had been answered, there was another 5-min. baseline period, followed by another questionnaire to report feelings. The second condition was then begun, followed by additional questionnaires to report reactions to the film(s).

In debriefing sessions, subjects were told about the videotaping. None reported having suspected that a camera was used. The subject was given the choice to either sign a second consent form for use of the video recording or have us destroy the video recording. All subjects consented.

Facial Measurement

The facial activity shown by each subject during the positive and negative conditions was measured with Ekman and Friesen's (1976, 1978a) Facial Action Coding System (FACS). This system was designed to measure all visible facial behavior, not just actions that might presumably be related to emotion. FACS distinguishes 44 ***action units***. These are the minimal units that are anatomically separate and visually distinguishable. Any facial movement can be described in terms of the particular action unit that singly or in combination with other units produced it. In addition to scoring the action units, FACS can be used to specify exactly when each movement begins and ends.

One person (S.A.) scored all the facial activity shown by the 35 subjects. A second person scored a sample of behavior that consisted of reactions in either the positive or negative conditions from 10 subjects and a 30-sec sample that was selected in a random fashion from each of the other 25 subjects. Intercoder reliability was evaluated by using a ratio in which the number of action units on which the two persons agreed was multiplied by two and was then divided by the total number of action units scored by the two persons. This agreement ratio was calculated for each event observed by one or both persons. The mean ratio across all events was .756, which is almost exactly the figure reported by Ekman and Friesen (1978b) for intercoder reliability. Other techniques for evaluating intercoder reliability in the scoring of the videotapes in this experiment also suggested that reliability was acceptable (Ancoli, 1979).

Results

Facial Signs of Positive Affect

It might seem obvious that the smile is the sign of positive affect. Yet some observers (Birdwhistell, 1970; Klineberg, 1940; LaBarre, 1947; Leach, 1972) have claimed that the smile is often a sign of negative affect. This disagreement may occur in part because the term *smile* is too imprecise, concealing quite different behaviors. Some of those who have measured facial behavior (especially Blurton Jones, 1971; Brannigan & Humphries, 1972; Grant, 1969) have distinguished more than one type of smile, for example, upper smile, broad smile, tight smile, and so forth. To complicate matters, these students of the face do not always list the same number of varieties of smiling nor do they specify just which ones, if any, are signs of positive affect.

The Facial Action Coding System (Ekman & Friesen, 1978b) takes a different approach. It does not utilize the term *smile* but allows for description in nonaffective terms of all visibly distinctive facial actions. A smiling appearance, in which the lip corners are pulled upwards, to some extent can be produced by the action of zygomatic major, zygomatic minor, buccinator, risorious, or caninus muscles. FACS allows for scoring each of these actions, combinations of these actions, and combinations of these with still other facial actions. Quite separate from FACS descriptive measurement of facial activity, Ekman and Friesen (1978a) predicted which actions are signs of positive affect. Based on hunch and observation, and partially supported by the hunches of other observers (in particular, Darwin, 1872/1955, and Tomkins, 1962, 1963), Ekman and Friesen predicted that among the many smiling actions, only those produced by zygomatic major (which FACS scores as Action Unit 12) are signs of happiness. Furthermore, they hypothesized that when Action Unit 12 combines with any of the other smiling actions or with certain other facial movements, such as tightening, pressing, stretching, pursing, pushing up the lower lip, or raising the upper lip, the meaning of the expression is changed. It may be controlled happiness, simulated happiness, or an instance in which positive affect has blended with, comments on, or masks negative affect.

Happy or not. The first test of whether facial actions provide information about differences in the experience of positive affect—specifically of the hypotheses that Action Unit 12 is the sign of such positive affect—was to compare the happiness ratings of those who showed this action and those who did not. There were only seven subjects who never showed Action Unit 12 in either the gorilla or the puppy film. These people reported being less happy (mean happiness rating across the two films was 1.79) than those who showed Action Unit 12 ($M = 3.74$), $t(32) = 2.44$, $p < .02$. When the facial behavior and self-report were analyzed separately for each positive film, the same results were obtained for the reactions to the gorilla and the puppy films.

How happy. The next test of the hypotheses about Action Unit 12 was to determine if variation in the amount of Action Unit 12 was associated with variation in the subjective experience of happiness. Two analyses examined this question. One determined whether FACS scores were correlated with self-reports of the intensity of happiness. The other determined whether FACS scores would allow accurate prediction of which positive film the subject had reported liking most.

Three measures of Action Unit 12 were correlated with the self-report of happiness. One

Table 1
Correlations Between Measures of Action Unit 12 and Reports of Happiness

	Gorilla film ($n = 20$)		Puppy film ($n = 23$)	
Facial measure	Raw score	Change score	Raw score	Change score
Frequency of Action Unit 12	−.08	−.01	.60***	.31**
Duration of Action Unit 12	.20	.35**	.21*	.16
Maximum intensity of Action Unit 12	.17	.34**	.04	.20

* $p = < .10$. ** $p = < .05$. *** $p = < .01$.

Table 2
T Tests Between Self-Reports of Happiness When the Face Showed More or Fewer Signs of Action Unit 12

Facial measure	*n*	Mean happy self-rating for film predicted on basis of facial measure to be: Most happy	Least happy	*t*	*p*
Frequency	24	3.95	3.29	1.35	.19
Duration	27	4.22	3.26	2.30	.03
Maximum intensity	21	4.29	3.19	2.18	.04
Combination of frequency, duration, and maximum intensity	24	4.33	2.96	3.27	.003

measure was the frequency and another was the duration of Action Unit 12 during a positive film. The third measure was the maximum intensity—slight, moderate, or extreme —that this action reached during a positive film. Subjects who showed no Action Unit 12 activity were excluded from this data analysis, as the previous analysis had established that they would anchor the low end of the facial activity and self-report variables.

Each of the three measures was correlated (taus; Nie, Hull, Jenkins, Steinbrenner, & Bent, 1970, chap. 18) with the self-reported happiness score for a positive film (raw score) and with the difference between that score and the happiness reported during the previous baseline period (change score). Table 1 shows that the amount of Action Unit 12 was generally correlated with variations in the self-report of happiness. Which particular measures were significantly correlated differed for the two films. It does not seem appropriate to attempt an explanation of variations in the magnitude of these correlations until these findings are replicated.

The second approach to the question of whether variation in Action Unit 12 was a sign of variation in the subjective experience of happiness was to determine whether the amount of Action Unit 12 would predict which of two happy experiences was the happier. Although there were no significant differences in the amount of happiness reported for the puppy and gorilla films, and the reports to each were correlated (Pearson $r =$ .41, $p < .05$), most subjects had rated one or the other film as producing more happy feelings. For each subject, the amount of Action Unit 12 produced during the gorilla and puppy films was used to predict which film the subject subsequently rated as producing stronger happy feelings. This prediction was made separately on the basis of the three measures of Action Unit 12—frequency, duration, and maximum intensity. Subjects who did not differ between films in their use of Action Unit 12 on a particular measure were excluded from the data analysis. A prediction also was made utilizing all three measures (frequency, duration, and maximum intensity) and selecting as the happiest film the one on which at least two of the three measures agreed.

Table 2 shows that the facial measures accurately predicted which film a subject reported as producing more happiness. The analyses in Table 2 used the raw happiness reports. When change scores (differences from baseline) were analyzed in the same fashion, the same results were obtained.

Contrary to Ekman and Friesen's hypothesis, it is possible that when a person watches a pleasant film, any facial movement, not just Action Unit 12, might be related to reports of happiness. To check this possibility, frequency and duration scores for all facial activity other than Action Unit 12 were calculated. The scores included smiling appearances produced by risorious, caninus, buccinator, and zygomatic minor muscles, as

Table 3
Differences on Self-Reported Emotion Between Those Who Did and Did Not Show Negative Facial Actions

Facial actions	Mean self-reports about the two accidents						
	Disgust	Surprise	Sadness	Fear	Pain	Arousal	Interest
Negative M (n = 21)	4.48	5.14	2.95	5.14	5.93	6.24	4.83
Nonnegative M (n = 12)	3.08	3.13	1.25	3.13	3.42	4.33	3.75
t	1.54	2.59	2.03	2.09	3.04	2.69	1.35
p	.067	.007	.026	.023	.002	.006	.185

Note. All tests are one-tailed except for anger and interest, which are two-tailed.

well as other facial actions in which the lip corners are not pulled up. These scores were not significantly correlated with happiness self-reports in either film and did not predict which films the subject had liked best.

To summarize, measurement of a specific facial action produced by the zygomatic major muscle, Action Unit 12, accurately differentiated reported differences in positive affective experience. The more Action Unit 12, the more happiness the subjects subsequently reported. The amount of Action Unit 12 predicted which of two films would be rated as having produced the strongest happy feelings. And subjects who never showed Action Unit 12 reported less happiness than those who did. Similar questions were asked about facial activity and negative affect.

Facial Signs of Negative Affect

Unhappy or not. Among the variety of actions scored by FACS, there is a subset that Ekman and Friesen hypothesized as being signs of anger, fear, disgust, sadness, contempt, or blends of those emotions. Forty-one percent of the facial movements that occurred when the subjects watched the accident film involved such facial actions. The first test of the hypotheses about which facial actions show negative affect was whether those subjects who never showed such facial activity reported experiencing less negative affect than those who did show such facial actions. Twelve subjects never showed the facial actions hypothesized as negative affect signs. Most of these subjects showed facial behavior interpreted by Ekman and Friesen as positive or ambiguous. The affective self-reports averaged across the two accidents were compared for these 12 persons and 21 persons showing negative facial actions. (Two more subjects, whose facial behavior was ambiguous, were excluded because negative action units were shown considerably before the appearance of the first accident.)

Table 3 shows that those who showed actions hypothesized as signs of negative affects reported significantly more fear, pain, sadness, surprise, and arousal than those who did not. The trend was in the predicted direction for reports of interest and disgust, but not for anger.

How unhappy. The next test of the hypotheses about those facial actions that show negative affect was to determine whether these actions correlated with the self-reports of the intensity of specific negative emotions. Table 4 shows that these facial actions correlated with the self-reports (averaged across the two accidents) for some of the negative emotions as well as with the report of generalized arousal.

How disgusted. The next issue was whether the specific predictions about the facial signs of particular negative emotions are correct. These hypotheses could be tested by determining if variations in facial signs of a particular negative emotion were associated with variations in the subjective experience reported for that emotion. So, for example, actions predicted to be signs of disgust should correlate with the report of disgust more than with reports of sadness, fear, or pain; actions predicted to be signs of fear should correlate with the report of fear more than with the

Table 4
Correlations Between the Sum of All Negative Facial Actions and Reports of Specific Emotions

Facial measure	Self-report					
	Disgust	Anger	Sadness	Fear	Pain	Arousal
Frequency scores	.21*	−.04	.14	.19*	.35***	.32***
Duration scores	.22**	−.10	.10	.12	.33***	.25***

Note. $N = 35$. * $p < .10$. ** $p < .05$. *** $p < .01$.

reports of disgust, sadness, or pain, and so forth. It was possible to test hypotheses only about disgust, since very few subjects showed action units relevant to any of the other negative emotions.

Thirteen subjects showed facial actions hypothesized as signs of disgust without showing actions relevant to any of the other negative emotions. (These appearances involve pulling upward the central portion of the upper lip, raising and stretching the nostril wings, and deepening the nasolabial fold. They are produced by levator labii superioris; caput infraorbitalis, Action Unit 10; and alaeque nasi, Action Unit 9, which also wrinkles the bridge and sides of the nose.) The top portion of Table 5 shows that these facial actions were correlated with the self-reports of disgust and not at all, or negatively, with the reports of anger and sadness. Contrary to predictions, one of the disgust facial action measures was significantly correlated with the report of fear, and there was a trend with the pain report. Suspecting that these findings on fear and pain might be due to general arousal rather than the specifics of these emotions, we calculated correlations partialing out the self-report of arousal. The middle rows in Table 5 show that the correlations between disgust facial actions and the self-report of disgust survived, whereas the relationship between these facial actions and the report of fear or of pain weakened. The pattern of partial correlation thus supports the hypothesis that these particular facial actions are specific to the subjective experience of disgust.

It might be argued that when people watch an unpleasant film, any facial activity, not

Table 5
Partial Correlations Between Facial Actions and Reports of Specific Emotions, Controlling on the Self-Report of Arousal

Type of correlation	Facial measure	Self-report				
		Disgust	Anger	Sadness	Fear	Pain
Tau						
	Disgust frequency scores	.37**	−.35**	−.46**	.28	.16
	Disgust duration scores	.55***	−.23	−.20	.46**	.41*
Partial, controlling on arousal						
	Disgust frequency scores	.31	−.32	−.52	.05	−.11
	Disgust duration scores	.52	−.19	−.22	.31	.24
	Ambiguous frequency scores	.10				
	Ambiguous duration scores	.29				

Note. $N = 35$. * $p < .10$. ** $p < .05$. *** $p < .01$.

just Action Unit 9 or 10, would be associated with the experience of disgust. This was not the case. The bottom two rows of Table 5 show that the ambiguous facial actions correlated less with the report of disgust than did the disgust facial actions.

Discussion

Facial action was found to provide accurate information about a number of different aspects of the subjective experience of emotion. Variation in specified facial actions was related to the intensity of reported emotions, to the extent of happiness, and to the extent of unhappiness. Even when a person reported enjoying two experiences, facial measurement discriminated which was enjoyed most. And there was evidence to suggest that facial actions may be specific to each negative emotion.

Although others (e.g., Birdwhistell, 1970) have claimed that smiling occurs with negative as much as with positive emotions, this study supported Ekman and Friesen's hypothesis that a particular type of smile—Action Unit 12 produced by the zygomatic major muscle—is associated with the experience of happiness. Some support was also obtained for Ekman and Friesen's hypothesis that only this action is a positive sign. Smiling actions in which the upward curve of the lip corners is produced by risorious, buccinator, or zygomatic minor muscles (predicted to be signs of fear, contempt, and sadness) occurred almost exclusively during the accident film.

Since Action Unit 12 was not totally absent during the accident film, the argument could still be made that even this type of smile may be a sign of negative emotion. Although not conclusive, the evidence suggests this is not so. At least it would be a rare sign of negative emotion, for Action Unit 12 occurred only about one tenth as much during the accident as during the gorilla/puppy film. Furthermore, the occurrence of Action Unit 12 during the accident film was not related to the self-report of negative emotions or positive emotions.

Ekman and Friesen (1975, chapter 11) have outlined a number of reasons why Action Unit 12 may occur during negative affect, even though they maintain that this action is not a sign of negative affect. Quite the contrary. Signaling positive emotion, Action Unit 12 may be deployed in a number of negative contexts: to comment on the negative feelings (e.g., grin and bear it); if there is a blend of positive and negative feelings (e.g., scorn, bittersweet, etc.); to mask a negative feeling; or to deliberately, falsely simulate the appearance of positive feeling. Two further findings about Action Unit 12 expressions during the accident film were consistent with these interpretations. First, almost half of them were part of expressions that also included actions that signify negative emotions. This virtually never occurred for Action Unit 12 expessions during the gorilla/puppy film. Second, preliminary analyses suggest that during the accident film, Action Unit 12 expressions were more asymmetric than during the gorilla/puppy film. This fits with other findings (Ekman, 1980; Lynn & Lynn, 1938; Ekman, Hager, & Friesen, in press) that when Action Unit 12 is a sign of spontaneous happiness, it is more symmetrical, and when it is deliberately performed, it is more asymmetrical.

Finally, it should be acknowledged that some of the Action Unit 12 expressions during the accident film could have been instances in which positive affect was felt. There are probably few experimental manipulations of negative affect that totally succeed for all subjects continuously and that do not strike at least a few, at least for a moment, as ridiculous or amusing. And, of course, subjects may at points show a happy expression in relief once they realize that the negative affect manipulation is not going to be as terrible as they feared.

The findings on the facial actions relevant to negative affect, and in particular for disgust, were encouraging. They are consistent with findings on the meaning of particular facial actions in studies of posed behavior. They should be replicated with other stimulus films and with other events apart from film as the source of negative affect. Similar research is needed also to test hypotheses about the facial actions signaling anger, fear, sad-

ness, pain, and surprise; variations in the intensity of each of these emotions; and blends of these emotions. To demonstrate more conclusively the specificity of the emotional information signified by a particular set of facial actions—that they are associated with one but not with another negative emotion—a comparison is needed that could not be made in this study. It is necessary to show not only that disgust actions correlate with disgust more than with anger reports (as found in this study) but also that anger actions correlate with anger more than with disgust reports. To make such a comparison, emotion-inducing stimuli would have to be used that would elicit facial actions relevant to anger and actions relevant to disgust.

More generally, this experiment demonstrated that facial expressions are differentiated for the spontaneous occurrence of particular emotions. It thus strengthens the empirical base of the theories of emotion that emphasized differentiated response systems, particularly those that dealt extensively with the face (Plutchik, 1962; Tomkins, 1962, 1963; and theorists who derive from Tomkins, such as Ekman, 1977, and Izard, 1977). These findings should challenge the cognitive theorists of emotion to expand their formulation to accommodate differentiated facial expressions of emotion and to consider measuring facial expressions in their experiments.

How important spontaneous facial expressions of emotion may be as social signals was not addressed in this study, although these findings raise such a possibility. Before presuming that facial expessions provide clues to others about how a person feels, let alone the further assumption that feedback of how others react may influence the expressor's experience, two research steps must be taken. First, it must be shown that people who observed expressions, such as those shown in this experiment, would be able to make the differentiations that were achieved by the fine-grained, slowed motion measurement with FACS. Second, it must be determined whether facial expression will remain as rich a source of differentiated information about emotion when the subject is not alone but in the presence of others. Ekman and Friesen (1969) have theorized that in social situations, people wittingly and unwittingly manage their facial expressions of emotions following culturally based display rules specifying who can show what emotion to whom and when. Friesen (1972) began such work by showing differences between Japanese and Americans when they watched stress-inducing films in the presence of another person. It is likely that in some social situations, at least some people may amplify while others may conceal or disguise their expressions, but this remains to be studied.

This experiment also served to show the utility of FACS. Since all observable facial behavior was measured, not just some actions presumed to signify emotion (as in Izard's, Note 2, facial measurement technique), it was possible to test whether the presumptions were correct or not. Observers' global judgments of emotion, the most popular alternative for measuring information from the face, cannot isolate the particular actions that do and do not relate to a particular emotion.

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